

A MULTI-YEAR APPROACH FOR DETECTING AND MONITORING PLANT INVASIONS AND THE LONG-TERM ECOLOGICAL SUCCESS OF NPS RESTORATION EFFORTS

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Background:

Biological invasions are occurring at accelerated rates in nearly every major ecosystem (terrestrial, freshwater, and marine) on the planet (Mooney and Hobbs 2000). It has been hypothesized that many of these species are “qualitatively different” from other species in native communities, e.g. invaders may have no functional analogs in the invaded systems and thus exert undue influences on prevailing ecosystem processes in these communities (Chapin et al. 1996, Mack and D’Antonio 1998). These wide spread invasions are cause for alarm on the part of National Park Service land managers charged with preserving and protecting NPS lands and maintaining them unimpaired for the enjoyment of future generations. Invasion threat to NPS ecosystems is two-pronged and comes both from within (already established and expanding populations of non-native species) and without (incipient species that have not yet breached the ecological barriers required to establish on NPS lands).

NPS is currently using Exotic Plant Management Teams (EPMTs) to remove or reduce non-native plant infestations, but the effectiveness of treatments is not currently being monitored. Concurrently, fire programs have been using prescribed fire to reduce hazardous fuel accumulations; however, it is clear that fire often leads to establishment and/or expansion of non-native plant species (D’Antonio 2000). While the fire program does monitor treatment effectiveness for fuels reduction, it is not clear whether the relationship of fire to establishment of invasive plant populations will also be forthcoming over appropriate time periods. Beyond questions related to treatment effectiveness is an overarching question that seems appropriate for the I&M program to address: *Are restoration efforts in biologically degraded, disturbed plant communities resulting in persistent, resilient, self-sustaining populations of native plants over the long term?*

In 1989, at the Natural Areas Conference held at Knoxville, Tennessee, Dr. Eugene Hester, NPS Associate Director Natural Resources, concluded his comments in the special session on exotic species control with the following statements (Hester 1991): “Research and monitoring are essential to document effects of exotics, develop effective management methods, and measure the results of management. Research into the ecological role of exotics in ecosystems is also important so that restoration of native ecosystems, rather than simply removal of exotics, can be achieved.” Fifteen years later we are proposing a bilateral approach to meet the goals of that earlier appeal. We believe that this approach will be of value to every NPS park and network with invasive species as a Vital Sign.

The Pacific West Region is an appropriate place to implement this strategy because each of the eight networks in the Pacific West Region identified invasive species as one of their top ecological monitoring issues and the diverse set of environments provided by these networks provide a rich testing ground for ecological theory. In addition, combating invasive species was

identified as one of the six action items to be addressed by the Natural Resource Advisory Committee (NRAC) and initial steps have already been taken to provide management support. Finally, this strategy will build on already established relationships between the Exotic Plant Management Teams, the Fire Monitoring program, the Inventory & Monitoring Program, NRAC, and the USGS Invasive Species team leader (Dr. David Busch) for the Pacific Northwest.

Objectives

We propose bringing USGS scientists, NPS scientists and resource managers together in a workshop this fall (CY 2004) to develop an action plan to address invasive non-native plants in the Pacific West Region. The bilateral approach suggested above would include research to develop early detection methods and long-term monitoring to determine if the management treatments being used will result in ecologically restored native plant communities. In addition, we propose integration and standardization of, potentially hierarchical, monitoring methods for EPMT, fire, and I&M programs. By tying these objectives together, we hope to ensure coordination and integration of taxa addressed and methods, when appropriate.

Objective 1: To develop and test an early detection protocol that would be applicable to the varied spatial contexts and ecological conditions of parks in PWR networks by building on already funded USGS early detection protocols.

We envision assembling a core team of key USGS and university scientists in the PWR to adapt and test the models and early detection protocols being developed by recently funded USGS scientists in other areas of the US (Caldwell, Smith, and Dorazio). The purpose of the models under development is to predict the susceptibility of various habitats to biological invasions and to detect new biological invasions. This coalition of key specialists will work together to adapt these hypotheses and protocols seamlessly to a range of western ecosystems from mesic to arid and to provide an unprecedented large-scale test of the early detection hypotheses generated.

Objective 2: To assist in developing an integrated inter-programmatic approach to monitoring the ecological success of NPS efforts to restore biologically degraded plant communities.

This objective would include identifying ecosystem altering invaders in the PWR and the development of monitoring questions, objectives, and methods (relative to invasive species) that are appropriate for each of the monitoring partners (EPMTs, fire, I&M). We propose that ecological monitoring would tier off a subset of the basic disturbance types produced by EPMTs, prescribed fire treatments, and even wildfire, if possible, in a sampling scheme designed to investigate the resilience of native plant communities, their resistance to future invasion, and their similarity to undisturbed, uninvaded plant communities on similar sites across a range of ecological conditions. USGS assistance is needed to develop a tiered approach to sampling, sampling strategies to answer monitoring questions, identify hierarchical data collection methods, and to develop an integrated database. This objective integrates both short (EPMTs, fire) and long-term (I&M) monitoring and an experimental sampling design to address the monitoring objectives of all three monitoring partners.

Method

We propose the timeline below for holding the workshop in CY 2004 and a rough estimate of activities in subsequent years.

FY/CY 2004:

Hold a 3-day workshop early this fall with selected USGS, university scientists, and NPS personnel to develop an action plan. The workshop would address different aspects of the action plan on different days.

- Session 1, Objective 1: A small focused group of NPS and USGS scientists will discuss the integration of the funded invasive species early detection proposals and the potential to work with USGS and university scientists in the PWR to *adapt and test* the protocols developed in a wide range of environmental settings.
- Session 2, Objective 2: A larger meeting back-to-back with the first, in which several brief presentations could set the stage for the ecological and management issues related to monitoring invasive species, e.g. release from biotic constraints in new environments, alteration of ecosystem processes interacting with climate change and nitrogen deposition to enhance the establishment of invaders, vectors and invasion pathways, disturbance and the creation of “vacant niches”, general attributes of invaders, the importance of early detection in relation to the “lag times” observed during the establishment of invaders, the relationship between inter-annual climatic variability in the establishment of invaders, current monitoring concerns/methods of EPMTs and fire programs. A primary goal would be to identify a vision of what “success” would look like in terms of developing complementary, comprehensive early detection and status and trends protocols. This would also be an opportunity to formally identify the role of I&M in invasive species monitoring and to identify monitoring questions and objectives for each of the groups concerned.
- Session 3, Objective 2: Other meeting objectives could include discussion of a strategic approach to sampling (e.g. across environmental, disturbance or nutrient gradients), hierarchical sampling measurements for the 3 groups, and identification of “invaders of special concern” for each network. Focus groups could begin to develop conceptual models of invasive species life history dynamics for various key invaders or functional types of invaders and relationships to stressors that could be adapted by other networks.

FY 2005

- USGS meet quarterly to work on development and testing of early detection protocol (Obj. 1).
- I&M work with NRAC invasive species subcommittee to finalize vision of “success”. (Obj. 2)
- NPS/USGS finalize conceptual models, monitoring questions, objectives, and measurements. (Obj. 2)
- USGS/NPS finalize sampling strategy to facilitate integration of the groups’ objectives and identify options for analysis. (Obj. 2)
- USGS develop standardized measurements and integrated database structure for I&M, EPMTs/parks, and fire monitoring. (Obj. 2)

FY 2006

- USGS: Initiate pilot studies for early detection protocol in a few parks that differ significantly along the sampling gradients or strategies identified by USGS and NPS. Collect data, analyze, refine sampling strategy. (Obj. 1)
- USGS/NPS: Initiate trial of long-term monitoring protocol. Collect data, analyze, refine. (Obj. 2)

FY 2007

- USGS: Install additional plots to fill gaps in previous design (early detection protocol), collect data, analyze, refine if needed. (Obj. 1)
- USGS/NPS: Finalize long-term monitoring protocol. Obtain peer review. Implement. (Obj. 2)

FY 2008

- USGS: Finalize early detection protocol. Obtain peer review. Implement.

Budget: We envision that funding will be shared by USGS and NPS over several years.

Fiscal Year	FTEs/project	USGS Contribution	NPS Contribution
2004	Workshop		
2005			
2006			
2007			
2008			

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